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April 1, 2021

Docket Control
ARIZONA CORPORATION COMMISSION
1200 West Washington Street
Phoenix, AZ 85007

RE: Arizona Public Service Company (APS or Company)
2020 Renewable Energy Standard Implementation Plan
Docket No. E-01345A-19-0148

Decision No. 77855 (December 31, 2020) requires APS to file by April 1, 2021 the Distributed Demand-Side Resource (DDSR) Aggregation Tariff required by Decision No. 77762 (October 2, 2020), which should permit the aggregation of distributed demand-side resources as defined by the Energy Rules, Decision No. 77829 (November 23, 2020).

At the March 23, 2021 Open Meeting, the Commission voted to extend the deadline to May 1, 2021, and APS committed to filing a project status report on April 1, 2021.

Attachment A to this letter is the DDSR Progress Report, which provides greater detail on the research completed to date and outlines the roadmap for continuing stakeholder engagement and tariff development. Attachment B is a survey of DDSR-related tariffs and customer programs completed by APS and consultants the Company has engaged to assist in the development of the DDSR Aggregation Tariff, including Energy and Environmental Economics (E3) and Guidehouse. This survey was also filed on March 24, 2021 in response to a request from Commissioner Sandra D. Kennedy.

Please let me know if you have any questions.

Sincerely,

/s/ Rod Ross

Rodney J. Ross

RJR/bg
Attachments

ACC - Docket Control - Received 4/1/2021 5:40 PM
ACC - Docket Control - Docketed 4/2/2021 8:23 AM

Attachment A

Arizona Public Service Company

Distributed Demand-Side Resource (DDSR) Aggregation Tariff

Progress Report

April 1, 2021

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Introduction

This report provides information on Arizona Public Service Company's (APS or Company) progress toward developing a distributed demand-side resources (DDSR) Aggregation Tariff. APS submits this report pursuant to Decision Nos. 77855 and 77762 which require APS to file a DDSR Aggregation Tariff to encourage the aggregation of DDSRs. APS submits this progress report to outline work performed to date, offer proposals that will provide data to support DDSR tariff designs, and inform the Arizona Corporation Commission's (ACC or Commission) decision on APS's request for an extension of time to file a tariff to May 1, 2022.

Decision No. 77762 ordered APS to file a tariff permitting the aggregation of distributed energy storage systems. Decision No. 77855 set a date of April 1, 2021 to file a tariff and specified that the tariff should permit the aggregation of DDSRs and provide compensation for the value of various operating characteristics including, but not limited to, capacity, demand reduction, load shifting, locational value, voltage support, ancillary and grid services, and any other operating characteristic to be considered. The decision further ordered that stakeholders be given the reasonable opportunity to review and comment on the tariff's values and applicable technologies.

To date, APS has held four stakeholder meetings on December 16, 2020, February 19, 2021, March 8, 2021, and March 29, 2021 and multiple informal meetings with stakeholders to gather input in developing the tariff. APS also engaged Energy and Environmental Economics (E3) and Guidehouse to support APS in designing the tariff and performing the valuation analysis. On March 9, 2021, APS filed a request for an extension of time to file its DDSR Aggregation Tariff, and on March 16, 2021 filed a revision requesting the filing be extended to no later than May 1, 2022.

At the March Open Meeting, the ACC extended the filing date to May 1, 2021 to allow Staff time to review progress, receive input from stakeholders, and provide a proposed order. On March 30, 2021, Staff filed a proposed order stating that no stakeholders objected to the May 1, 2022 extension, and Staff recommended the extension be granted.

DDSR Tariff Design Progress Update

APS engaged with E3 and Guidehouse to support the Company in designing the tariff and performing the valuation analysis. Both firms have supported APS with its demand-side management programs, integrated resource plan valuation process, and bring experience supporting similar tariffs in other jurisdictions, including work in collaboration with Lawrence Berkeley National Laboratory (LBNL).

With the support of these firms, APS developed a tariff design and assessment framework and conducted a survey of 50 tariffs and programs from 19 utilities across 12 states, as well as a review of existing and upcoming APS programs that include aggregation of demand-side resources. The team found that the timelines for developing similar tariffs in other states and jurisdictions typically involve 2-5 years of planning and testing and that most of these tariffs and programs are specific to a single technology. In addition, the compensation mechanisms for many tariffs are designed to promote technology adoption and not to account for valuation of grid benefits, particularly for locational and ancillary services. The framework and results of the survey were presented and discussed with stakeholders on February 19, 2021. APS provided the findings of

this survey to LBNL on March 3, 2021 and filed with the ACC on March 24, 2021. (See Attachment B.)

Project research has covered 50 DDSR-related tariffs and programs deployed by 19 utilities in 12 states.

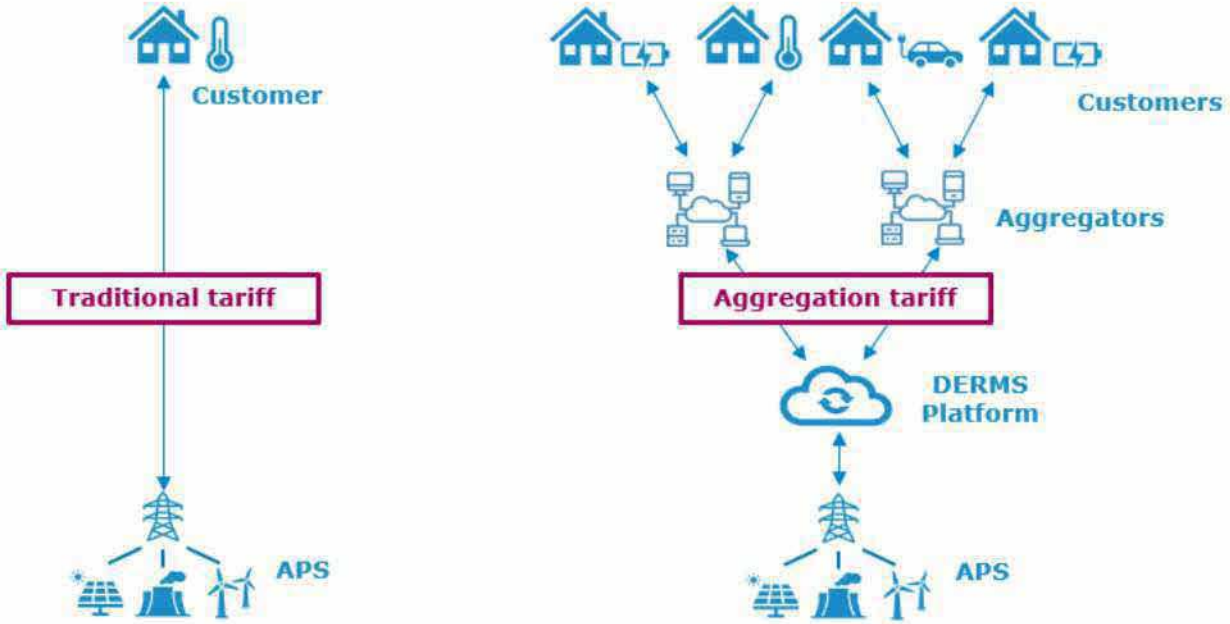
In developing the proposed tariff, APS is collaborating with many stakeholders. APS has held frequent meetings with stakeholders to provide updates on our research and gather feedback to inform the design. Nearly 30 stakeholders attended each of the stakeholder meetings on February 19, 2021, March 8, 2021 and March 29, 2021. As part of these meetings, APS reviewed DDSR technologies and operational characteristics to be included in the tariff, the tariff design framework, results of the tariff survey, plans for on-going stakeholder engagement, existing and upcoming APS programs with aggregation capabilities, and introduced two initiatives to support the tariff design.

Stakeholder feedback centered on the need for simplicity with a straightforward program offered in the near-term that supports development of DDSRs and provides strategic learnings to inform future program designs. The program should provide direct payments to the customer that maps to the value provided by the resource and provide certainty around the program length for customers. Stakeholders recognized the complexity of properly valuing DDSR operating characteristics and felt that compensation in the near-term could be based on system-level benefits to allow more time to develop location-specific services and values.

In the March 29 stakeholder meeting, multiple stakeholders provided input supporting extended time to file a tariff, indicating that it was more important to 'get it right' than to rush to release a preliminary tariff that could have unintended consequences. Stakeholders were also supportive of APS's proposals to expand the Residential Energy Storage Pilot and to issue an all-DDSR RFP to inform tariff design.

The Electric Power Research Institute (EPRI) has researched DDSR aggregation issues nationally and provided the following feedback and considerations regarding the complexity of properly valuing and compensating operational characteristics of DDSRs.

- Capacity value and resource adequacy assessments are much more complex today than in the past. The growing awareness of system flexibility needs means a particular resource's capacity value is not just a simple number, but is multi-dimensional as the system resource mix continually changes.
- To realize the value of aggregated resources requires that the resources be fully integrated into the planning process and utility operations. This can be a complex and lengthy undertaking apart from tariff design.



Aggregation tariffs involve more parties and operating coordination than traditional tariffs.

- Metering and financial settlement between aggregated services and retail rates is complex and needs to be addressed in order to avoid double counting and double payment. Measurement and verification of aggregated loads is critical to avoiding cross subsidies from non-participants to participants and aggregators.

LBNL is assisting the ACC in tariff valuation and assessment, and APS has held coordination meetings with LBNL to discuss valuation approaches and project data needs. During the February 18, 2021 ACC Staff Meeting, LBNL recognized the importance of stakeholder interaction and the need for additional time beyond April 1, 2021 to develop a tariff.

Another important consideration in developing a tariff is the context of current APS demand-side management (DSM) programs that work with technology providers and aggregators to provide benefits for APS customers. APS has already successfully integrated DDSR aggregation into its comprehensive portfolio of DSM programs that combine consistent and reliable load reductions achieved through energy efficiency with peak demand reduction and load shifting capabilities resulting from new and emerging DDSR technologies.

APS has partnered with EnergyHub to provide aggregation for more than 35,000 connected smart thermostats in the APS's Cool Rewards program, which provides grid services including summer peak demand response capacity and load shifting capabilities. The program achieved 42 MW of demand reduction in 2020. In 2021, APS plans to grow the program to more than 100 MW of demand reduction through innovative partnerships with thermostat manufacturers such as Google/Nest and ecobee that offer customers deep discounts on smart thermostats and by expanding the program to include small business customers – with a goal to connect more than 100,000 additional smart thermostats this year.

APS is also in the process of launching new, recently approved DDSR aggregation programs that will provide additional load shifting and peak demand grid services through residential battery storage, rate-optimized thermostats, and connected water heater and pool pump controls.

In the commercial sector, APS recently completed an RFP process and selected CPower to implement APS's commercial/industrial demand response aggregation program, Peak Solutions. The program provided 30 MW of demand reduction in 2020, and APS plans to grow the program to 60 MW in 2021 and 75 MW in 2022.

APS has a long history of implementing successful DSM programs. In response to direction from the ACC in Decision No. 75679 (August 5, 2016), APS has moved to evolve the DSM portfolio to focus on aggregating DSM solutions that can provide energy efficiency, load shifting and peak demand management benefits with connected DDSR technologies. APS is focused on designing an effective DDSR tariff while also considering potential impacts the tariff will have on existing successful DSM programs currently aggregating DDSRs and their ability to deliver on APS's annual energy and demand reduction goals.

Proposed Initiatives to Inform Tariff Design

As noted above, because of the complexity of this tariff, determining the value streams for each of the DDSRs will take additional time. To advance the tariff valuation process outlined in the order and respond to the feedback and input received from stakeholders, APS is proposing to add a performance payment component to the Residential Energy Storage Pilot. APS is also preparing to issue an all-DDSR Request for Proposals (RFP) that will allow aggregators to directly bid to provide capacity, load shifting and other grid services with aggregated DDSR technologies. Each of these initiatives (described in further detail below) are being undertaken to ensure we develop a holistic and inclusive tariff design that is well informed by market data while providing sufficient time to conduct the necessary research, analysis, planning, and stakeholder engagement.

- **Add a Performance Payment Option to the Residential Energy Storage Pilot**
  APS is currently working to launch the Residential Energy Storage Pilot that will offer up to a $2,500 incentive for residential customers who install battery storage systems and connect to the APS Rewards Operating Platform to share battery performance data. To inform the DDSR tariff design, APS is proposing to modify the pilot to offer an additional $1,250 upfront incentive for customers who agree to share a portion of their battery capacity to serve grid needs. Customers would receive an additional upfront, one-time payment for a three-year commitment to share up to 80% of their storage system's capacity for a maximum of 100 events a year. APS will make this proposal in its upcoming Revised 2021 DSM Implementation Plan filing.

  This option responds directly to stakeholder requests for a near-term and simple program option that provides compensation to customers for the value provided from the capacity of their energy storage system. It will also provide valuable data on DDSR technology performance to help inform the DDSR Aggregation Tariff. Funding for this additional incentive will come from the existing budget allocated for the pilot. APS requests expedited

ACC approval to proceed with this important addition to the Residential Energy Storage Pilot in a timely manner.

- **Issue an RFP to Aggregate DDSRs**
  APS intends to issue an all-DDSR RFP in the second quarter of 2021. This planned RFP will look to the market for DDSR technology solutions and aggregation business models that consider all DDSR technologies (including bundling of energy efficiency) contemplated within the order. APS plans to seek aggregated DDSR solutions to address systemwide needs and to also include locational needs that could be addressed on specific feeders, including voltage regulation and other ancillary services included in Decision No. 77855 (December 31, 2020) to support the valuation of operating characteristics for deployed technologies. To help ensure resource reliability, the RFP will include performance guarantees and penalties for non-performance by aggregators to provide market-based cost information.

Summary and Next Steps

APS looks forward to working closely with stakeholders, LBNL and the Commission to continue developing and designing a DDSR Aggregation Tariff that encourages innovative approaches for serving grid needs and providing customer value. While this is being developed, APS intends to proceed with initiatives that gather and respond to stakeholder input and help inform the path forward for the tariff including:

- Proposing to launch a new performance payment option to be added to the Residential Energy Storage Pilot for participants who agree to share a portion of battery storage capacity to serve grid needs;
- Issuing an all-DDSR RFP to gain market information on DDSR technologies and aggregation business models to inform the tariff design and valuation process;
- Continuing to hold regular stakeholder meetings throughout the tariff design process to provide updates on program activity, answer questions and receive input. APS will continue to file stakeholder meeting summaries to this docket;
- Working collaboratively with LBNL as needed to help provide data and coordinate with its tariff analysis work on behalf of the ACC; and
- Providing regular updates to the ACC on progress toward valuing the six defined operating characteristics and filing a tariff.

Appendix A: Stakeholder Feedback

The following feedback was provided by EPRI via email to APS on March 5, 2021.

Capacity and Demand Reduction Value:

- There is a long history of determining capacity value for qualifying facilities under PURPA. However, capacity value and resource adequacy assessments are much more complex today than they used to be, especially considering the variety of resources available. The growing awareness of system flexibility needs means a particular resource's capacity value is not just a simple number, but is multi-dimensional as the system resource mix continually changes.
- To realize the value of aggregated resources requires that the resources be fully integrated into the planning process and utility operations. This can be a complex and lengthy undertaking apart from tariff design.
- Metering and financial settlement between aggregated services and retail rates is complex and needs to be addressed in order to avoid double counting and double payment. There are pros and cons to different metering and settlement arrangements related to differentiating exports/imports from a single meter vs. submetering devices located behind a customer retail meter.
- Perhaps APS's Peak Solutions program to facilitate demand response can be referenced/expanded upon to partially address the ACC's request.

Locational Value:

- This seems mostly related to T&D deferral value. To realize this value, the aggregated resources must be located appropriately and integrated into the T&D capacity planning process through a non-wires alternative (NWA) program. A 2020 reference to the broad body of work EPRI has on the topic of NWAs can be found here: https://www.epri.com/research/products/000000003002018655.
- Initial experiences from California and New York indicate that there are some instances where NWAs can be cost-effective, but they do not yet seem to be pervasive as an economic alternative to conventional infrastructure. At the distribution level, the major challenges have been cost-effectiveness, technical adequacy, and challenges in meeting the interconnection timeline.

Other Thoughts:

- Measurement and verification of aggregated loads is critical to avoiding cross subsidies from non-participants to participants and aggregators.
- Given the low cost for conventional voltage regulation solutions, there is likely little value in voltage support. EPRI's 2019 study with PG&E shows the low value of implementing reactive power support functions via smart inverters for distributed PV systems: https://www.pge.com/pge_global/common/pdfs/about-pge/environment/what-we-are-doing/electric-program-investment-charge/PGE-EPIC-Project-2.03A_Modeling-Report.pdf.

- For ancillary and grid services, there may be FERC-regulated wholesale rate schedules for purchasing ancillary services through OASIS. Telemetry requirements may make it infeasible for smaller DERs.

Organizations Represented at Stakeholder Meetings	
Advanced Energy Economy	Inergy Systems
American Solar	Lawrence Berkeley National Lab (LBNL)
Aquanta	PureEnergy Solar
Arizona PIRG	Recurve
Arizona State University	Shifted Energy
AzISA	Southface
Ecobee	Sunrun
Efficiency First Arizona	Sun Valley Solar Solutions
DERA	SWEEP
Elevation Home Energy Solutions	Tucson Electric Power
EnergyHub	Tesla
Energy Storage Association	The Ad Hoc Group
Electric Power Research Institute (EPRI)	WRA
Harmon Solar	

Attachment B

Survey of Tariffs, Riders & Programs

APS Demand-Side Aggregation Tariff

March 2, 2021

Guidehouse

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Contents

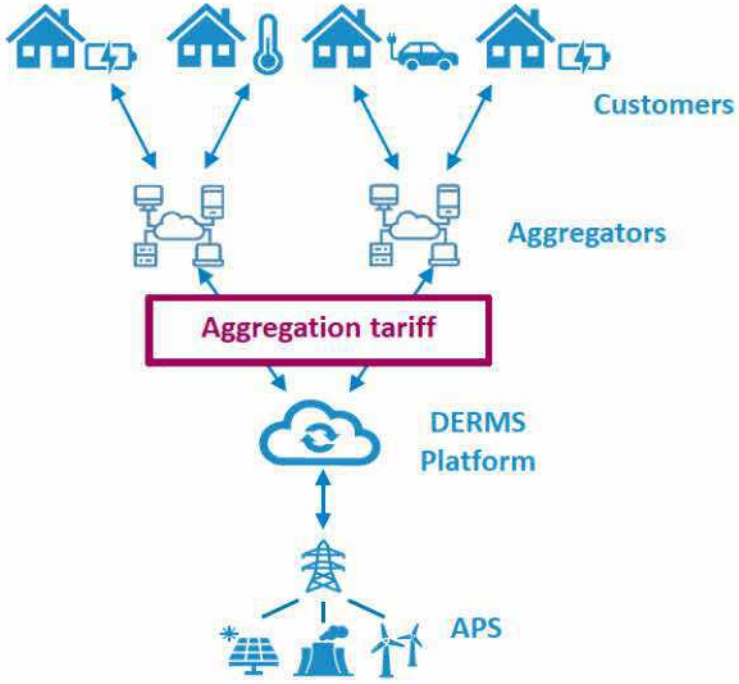
- Summary of Tariff Survey (Workshop Slides)
- Initial Tariff Scan
- Deep Dive on Energy Storage Programs
- Deep Dive on Locational Based DER

Workshop Slides

Summary of Tariff Survey

Defining an Aggregation Tariff

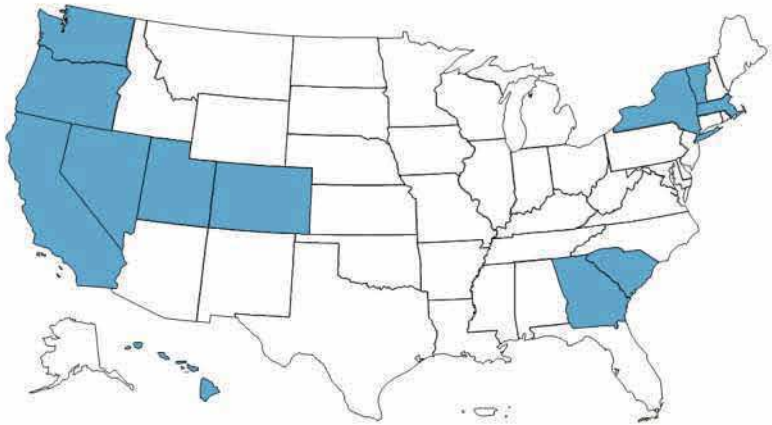
Aggregation tariffs involve more parties than traditional tariffs



Tariff Survey Takeaways

The team reviewed 50 tariffs and programs from 19 utilities across 12 states

- Compensation across programs / tariffs varies significantly and is either tied exclusively to grid value or includes additional payments to support market transformation
- System-level value streams (e.g., avoided energy and generation capacity) are often included in compensation; locational value streams (e.g., distribution deferral), are less common
- Most programs target a specific technology
- Many programs and tariffs enroll customers for 2- to 5-year commitments



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Tariff Attributes for Survey

The team created a set of key attributes to guide the survey

Program Attribute	Description
Compensation Type	**VB** – Value Based compensation reflects the grid value the program creates **MT** – Market Transformation compensation is designed to promote adoption
System Value	✓ DDSRs are compensated for system level value streams such as energy or generation capacity
Local Value	✓ DDSRs are compensated for local level value streams such as distribution deferral
Case-specific Value Calculation	✓ Value and payment is determined on a case-by-case basis
Performance Incentive	✓ Compensation is directly affected by how DDSRs perform
Program Length (years)	**# years** How long customers are locked into a specific compensation level
Technology Neutral	✓ The tariff/program does not exclude technologies
3rd Party Aggregation	✓ The tariff/program provides a specific role for a 3rd party aggregator
Direct Load Control	✓ The tariff/program involves direct load control of DDSRs

Tariff/Program Overview

Program Attribute	APS R-Tech Tariff	California IOUs Partnership Pilot	Green Mountain Power Res. Storage	HECO - EnergyScout	HECO – Grid Services Purchase Agreement	HECO - Smart Export	HECO/EnelX - Smart Charge Hawaii	National Grid Connected Solutions	NV Energy - Residential CPP	PGE Residential Storage Program	PSC/NYSERDA VDER	PSEG Long Island	Rocky Mountain Power - Cool Keeper	Avista – Micro-Transactive Grid	California IOUs – Microgrid Tariff	Duke Energy Power Manager	NYSEG – BTM Storage Pilot	PG&E – ChargeForward Pilot	PSE – Demand Side Management Pilot	PSE – Rush Hour Rewards Program	PSE – Up & Go Electric	SCE – Preferred Resources Pilot	SCE – Smart Energy Program	SDG&E – AC Saver Thermostat Program	Seattle City Light – Pilot EV program	SMUD – Energy StorageShares	Xcel – AC Rewards	Xcel – Storage Pilot Program
Compensation	VB	VB	MT	MT	MT	MT	MT	MT	VB	MT	VB	VB	MT	MT	MT	MT	MT	MT	VB	VB	MT	VB	MT	MT	MT	VB	MT	MT
System Value	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓			✓		✓	✓	✓		✓	✓
Local Value		✓	✓							✓	✓	✓			✓		✓		✓	✓		✓				✓		✓
Case-specific value		✓																								✓		
Performance Incentive	✓	✓				✓		✓	✓			✓						✓	✓	✓		✓						
Program Length (years)		5	2.5		4			5	1	5	25	4					3	2				7						3
Technology-Neutral	✓	✓						✓	✓					✓	✓				✓			✓						
3rd Party Aggregation		✓	✓	✓	✓		✓	✓				✓		✓			✓	✓	✓	✓	✓	✓	✓	✓	✓			✓
Direct Load Control		✓	✓	✓			✓	✓		✓		✓	✓	✓	✓	✓	✓	✓		✓	✓		✓	✓	✓		✓	✓

Guidehouse

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APS
R-Tech Pilot Tariff

The R-Tech rate captures important aggregation tariff features and could be a good prototype for APS to quickly build upon for the DDSR tariff.

- A dynamic three-part rate for residential customers
  - Basic service charge
  - Time varying energy charge: on-peak (3pm – 8pm weekdays), off-peak
  - Time varying demand charge: on-peak, off-peak (only for demand > 5kW)
- Customers are awarded for energy and delivery through bill savings
- A range of technologies are eligible, customers must have either 2 primary, or 1 primary and 2 secondary technologies to enroll:
  - Primary technologies: PV, Storage, EVs
  - Secondary technologies: Pool pump, HVAC, smart water heater, smart thermostat, automated load controller
- The aggregation tariff could adopt the R-Tech format with additional elements:
  - Enable an aggregator to provide direct load management through the tariff
  - Incorporate locational grid value into the tariff compensation

APS R-tech tariff	
Size of program	10,000 customer limit for the pilot
# of customers enrolled	54 customers as of 1/30/21
Duration of program	Tariff available since 2017
Cost of program	N/A
DDSR owner	Customer
Aggregator required?	No
Participant compensation	Bill savings
Valuation	Avoided costs including energy and delivery
Metering	AMI
DERMS	Not Required

R-Tech Tariff Sheet

PSEG Long Island

Residential Storage Program

Value-based compensation tied to existing demand response programs. Aggregators directly control energy storage during call events.

- Compensation based on avoided generation, transmission, and distribution [1]
  - Customers are enrolled into system peak demand response and distribution load relief demand response programs
- A cost-benefit study was performed to approve the program [2]
- Events are 4 hours in duration and occur from May to October
  - The program does not specify the number of events
  - The utility notifies aggregators of events 21 hours in advance and they are responsible for managing customers' batteries directly
  - In 2018, 4 events were called [3]

PSEG Long Island Residential Storage Program	
Size of program (MW)	7.6 MW storage capacity 3,468 kW of load reduction
# of customers enrolled	90 customers in 2019 720 customers by 2022
Duration of program	4-year program, proposal to lock incentives in for 10 years is pending
Cost of program	$3.4M
DDSR owner	Customer
Aggregator required?	Yes
Participant compensation	- Aggregators receive $96/kW-yr payment for both CSRP and DLRP - 0.25 $/kWh performance-based payment during events - Aggregator can decide how to compensate customers
Valuation	Avoided distribution, generation, and transmission costs
Metering	Separate meters
DERMS	EnergyHub's Mercury platform

1 Program Operational Guidelines 2 LIPA tariff for electric service updates

National Grid (Massachusetts)

Connected Solutions – Energy Storage

Higher compensation to help stimulate the residential storage market. This program is expected to yield ~30 MW of storage capacity.

- Compensation is intended to be market transformational
  - Performance based compensation awarded for **average kW curtailed over the season** and incentive is locked in for a 5-year period
- Event based residential battery storage program involving direct load control through an aggregator
  - EnergyHub enrolls customers, receives telemetry data from National Grid, and verifies performance
- Up to 60 summer events and 15 winter events each year
  - Events occur between 2 PM - 7 PM and last 3 hours
- Connected Solutions programs exist in other National Grid jurisdictions and for other DERs
  - Study into which DERs have the largest market potential informed the technologies chosen but involve different incentives and performance requirements

National Grid Connected Solutions	
Size of program (MW)	Anticipated to be 30-34 MW
# of customers enrolled	148 end of 2019
Duration of program	Locked in incentive for 5 years
Cost of program	N/A
DDSR owner	Customer
Aggregator required?	Yes
Participant compensation	- Compensated for average kW load reduction ($225/kW summer, $50/kW winter) - Payments go to aggregator or directly to customer
Valuation	Market transformation incentive, avoided energy, capacity, GHG emissions
Metering	Separate meters
DERMS	EnergyHub's Mercury platform

1 Program Page 2 Demonstration Evaluation

California Investor-Owned Utilities

Partnership Pilot

Aggregators bid to defer distribution capacity through a case-by-case assessment.

- Pilot for a distribution deferral tariff approved by the CPUC Feb 11, 2021 [1, 2]
- Utilities will use existing distribution deferral frameworks to identify deferral opportunities, costs, and value
  - Evaluating deferral opportunities on a case-by-case basis requires a longer timeline than avoided cost frameworks
- Utilities would procure DDSR capacity on case-by-case basis:
  - Utilities set DDSR procurement goals to cover capacity deferral for a specific period
  - Aggregators file offer reservations for portion or all the capacity need at the price set by the utility
- Utilities pay aggregators based on four-tier payment structure:
  - Deployment, Testing, Reservation, and Performance
- Aggregators enroll and control customer DDSRs

California IOUs Partnership Pilot	
Size of program (MW)	120% procurement margin
# of customers enrolled	None
Duration of program	5-year pilot
Cost of program	85% of the planned investment
DDSR owner	Customer
Aggregator required?	Yes
Participant compensation	Determined by aggregator
Valuation	Avoided distribution Capacity
Metering	AMI
DERMS	Yes

1 CPUC Decision 2 Staff Proposal

Tariff Survey

Initial Tariff Scan

Overview of Tariffs and Programs Reviewed

- Of the states reviewed by E3 and Guidehouse, California, Hawaii, and Washington have the most options available for compensating demand-side resources (DSRs)
- The research represent a combination of state-driven and utility-driven initiatives.
  - Some states such as Hawaii, California, New York, and Vermont have created larger frameworks from which utilities develop programs or tariffs that fit their needs
- Tariffs or programs reviewed had either value-based compensation or were more market transformational
- Many utilities have time varying technology-specific tariffs (e.g., EVs)
  - Notable examples include NV Energy's residential storage tariffs and GPC's residential TOU with demand charge tariffs
- Smart thermostats are the most commonly aggregated technology, though states are beginning to authorize battery programs
  - These programs include rebates for customers (Duke Power Manager), are purely BYOD programs (National Grid), or allow for the customers to pay over time from the utility (GMP Smart Thermostat/Water Heater Program)

Overview of Tariffs and Programs Reviewed

	Tariff	Rider or Program
Technology Neutral	California IOUs – Partnership Pilot California IOUs – Microgrid Tariff Xcel – AC Rewards GPC – RTP rate (Commercial) GPC – TOU/+Demand Charge (Residential) HECO Grid Services Purchase Agreement NV Energy – Residential Optional CPP Duke Energy Power Manager Green Mountain Power – Open Access Tariff	SCE – Preferred Resources Pilot SMUD – 2500 R Midtown Project Xcel – Storage Pilot Program HECO – Commercial Smart DR HECO – Large commercial Direct load control HECO – Smart Export PSC/NYSERDA – VDER Green Mountain Power – Whole Home Service Avista – Micro-Transactive Grid PSE – Electricity Targeted Demand Side Management Pilot
Technology Specific	PG&E – Home Charging EV2-A PG&E – EV-B (residential) HECO – Residential EV TOU RI & RI-EV only HECO – Proposed Commercial EV-J & EV-P NV Energy – Residential Storage (TOU + CPP + DC) NV Energy – EV Rate with Demand Charge Rocky Mountain Power – EV TOU Pilot Avista – EV TOU Rate (commercial) PSE – EV Rate (residential)	PG&E – ChargeForward Pilot PG&E – EV Charge Network (commercial/MuD) SMUD – Energy StorageShares (commercial) SMUD – Battery Storage Programs (residential and commercial) SCE – Charge Ready DR Pilot Program (commercial/MuD) SCE – Smart Energy Program SDG&E – AC Saver Thermostat Program California IOUs – SGIP HECO – Residential & small commercial EnergyScout HECO/EnelX – Smart Charge Hawaii EV Program National Grid – Connected Solutions NYSEG – BTM Storage Pilot PSEG Long Island PGE Residential Storage Program Rocky Mountain Power – Cool Keeper Program Green Mountain Power – Tesla partnership Green Mountain Power – Residential Storage Program Avista – EVSE Pilot Program PSE – Rush Hour Rewards Program PSE – Up & Go Electric Seattle City Light – Pilot EV charging program

California
Colorado
Georgia
Hawaii
Massachusetts
Nevada
New York
Oregon
South Carolina
Utah
Vermont
Washington

This table does not include 10 APS tariffs and programs that were also reviewed

California

Tariff, Rider, or Program Name	Tech Neutral or Specific?	Program Overview	Design Summary	Summary of Charges, Credits, Rate Details	EM&V	Stakeholder Context	Participation
Partnership Pilot (R. 14-10-003)	Neutral	A new tariff with a tiered payment structure open to any DER customer type. Behind-the-meter DER operate in response to dispatch signals communicated from a utility via an approved DER service aggregator, for the purpose of addressing grid needs and deferring distribution investment. (5-year pilot)	Four-tier payment structure: 1. Deployment – Install DER 2. Test – Confirm dispatch capability 3. Reservation – Reserve capacity and energy 4. Performance – DER are dispatched	To be determined.	N/A	A recent CPUC proposed decision adopting pilots to test two frameworks for procuring DER that avoid or defer utility capital investments.	None so far.
New Microgrid Tariff and Incentive Program (R. 19-09-009)	Neutral	"SCE, PG&E, and SDG&E shall each form a new microgrid tariff for their respective service territories"; this tariff will consolidate component technologies of a microgrid into a single rate schedule. The utilities must also develop an incentive program for clean energy microgrids.	Applicable to systems that: (1) meet the definition of microgrid in SB 1339; (2) involve a single customer / single account; (3) consist of resources that are interconnected under Electric Rule 21; and (4) consist of resources that are eligible for a NEM successor schedule.	To be determined. The rate schedules will make use of existing tariffs available to the resources that make up a microgrid.	N/A	A recent CPUC proposed decision responding to state law SB 1339 that requires regulatory changes to support microgrid development. The PD responds to many intervenors.	None so far.

California

Tariff, Rider, or Program Name	Tech Neutral or Specific?	Program Overview	Design Summary	Summary of Charges, Credits, Rate Details	EM&V	Stakeholder Context	Participation
SCE Preferred Resources Pilot	Energy efficiency, energy storage, demand response, solar PV	In 2013, SCE launched the Preferred Resources Pilot (PRP) to understand how a diverse portfolio of preferred resources can meet local capacity needs and load growth.	EE from business and residential customer programs for buildings and appliances; DR enabled by customer-sited energy storage; energy storage from customer programs such as the Self-Generation Incentive Program; renewable DG through programs and tariffs, including Single-Family Affordable Solar Homes, New Solar Homes Partnership, and NEM.	Various charges and credits by resource and program.	The 2018 PRP Annual Report.	SCE initiated its PRP to validate the State's DER performance assumptions that a portfolio of DER could perform like a large gas-fired power plant, while ensuring reliable and affordable energy delivery; approved by the CPUC.	A 200 MW portfolio will be available by 2021.
SMUD 2500 R Midtown Project	Solar PV, battery storage, smart thermostat, appliance controls	In 2014, SMUD launched and completed a small pilot to test use cases for aggregated behind-the-meter residential DER and control technology to provide grid benefits.	10 participants were on a TOU rate schedule with DER controlled as a fleet by SMUD.		The project demonstrated six use cases; the average home provided 2.66 kW demand savings during a conservation day; smart thermostat performance was inconsistent.	Key partners included Sunverge Energy Inc., ThinkEco, and Pacific Housing Inc.	34 single-family homes.

California

Tariff, Rider, or Program Name	Tech Neutral or Specific?	Program Overview	Design Summary	Summary of Charges, Credits, Rate Details	EM&V	Stakeholder Context	Participation
SMUD Energy StorageShares	Battery storage	Commercial customers install storage in a location with a distribution feeder system that is maxed out and is in line to be upgraded, and other customers buy a "share" of the battery system.	A share equals 1 kW in demand charge reduction			The program is part of SMUD's overall goal of having 9 MW of energy storage by the end of this year and 75 MW by the end of 2026.	Electrify America is the first Energy StorageShares program (4 MWh storage project with 4,000 shares).
SMUD Battery Storage Programs	Battery storage	Offering qualified residential and commercial battery storage customers an incentive for the commitment to operate the battery system to offset load during peak periods. Residential customers that install a SolarEdge inverter can receive additional incentives.	• Solar PV + battery: Commits that at least 51% of the proposed battery capacity will be used to shift energy generated from solar to offsetting loads during the on-peak periods. • Battery only: System owner commits that at least 51% of the proposed battery capacity will be used to shift energy usage from on-peak periods to off-peak periods.	Commercial Incentives: • 15kW - 30kW: $600 • 30.1 kW - 75kW: $1,000 • 75.1kW - 150kW: $2,000 • 150.1kW+: $5,000 Residential Incentives: • 1kW - 10kW: $300 • 10.1kW and above: $600 SolarEdge: $1,000 plus $20 monthly bill credits for enrolling in a managed program.			

California

Tariff, Rider, or Program Name	Tech Neutral or Specific?	Program Overview	Design Summary	Summary of Charges, Credits, Rate Details	EM&V	Stakeholder Context	Participation
Self-Generation Incentive Program (SGIP)	Battery storage, paired solar, electric vehicles	Through this statewide program the investor-owned utilities provide incentives when residential customers install a battery storage system and offers increased incentives for customers who are more vulnerable during power outages.	Customers eligible for this incentive can use Time-of-Use rates or Home Charging rates, and NEM rates for systems paired with solar.	• Equity Resiliency incentives: Up to 100% of battery costs ($1.00/Wh) • Equity incentives: Up to 85% of battery costs ($0.85/Wh) • General Market battery incentives decrease over time	2018 Advanced Energy Storage Impact Evaluation	Program from the CPUC administered by the IOUs.	Equity and General Market are fully subscribed.
SCE Charge Ready DR Pilot Program	Electric vehicles	A voluntary pilot program that targeted commercial and multi-unit dwelling customers, demonstrating the capability to shift and reduce loads by up to 50%.	Automatic opt-in system.	SCE provided equipment rebates and covered the cost to install the equipment.	The program reduced load by an average of 42% at participating sites during DR events in 2018.		
PG&E ChargeForward Pilot	Electric vehicles, battery storage	A pilot in partnership with BMW using its proprietary aggregation software and app. Phase 1 focused on demand response, Phase 2 on maximizing renewable energy intake and DR.	BMW used both EVs and tested 2nd life batteries. The aggregation software delayed charging using cellular telematics.	$1,000 incentive	BMW met 90% of load requirements for DR events with an average 20% contribution from EVs and 80% from the 2nd life battery systems.		• Phase 1: 96 BMW i3 drivers • Phase 2: 350 participants

California

Tariff, Rider, or Program Name	Tech Neutral or Specific?	Program Overview	Design Summary	Summary of Charges, Credits, Rate Details	EM&V	Stakeholder Context	Participation
PG&E EV Charge Network	Electric vehicles	Focused on commercial and multi-unit dwelling customers that choose Custom Pricing; the Load Management Plan utilizes a demand response pilot program. As a part of this program participants shift the amount of EV charging at their site to support the grid.	TOU rate. By ~5 pm on the day before an event, participants will be notified of the type of event: • Events to increase charging: 8 am to 1 pm • Events to decrease charging: 4 to 9 pm	An incentive payment calculated based on performance; comparing the usage during an event hour to the site's average usage on recent, non-event days.		List of approved vendors	35 sites enrolled / fully subscribed
PG&E Home Charging EV2-A	Electric vehicles, battery storage	One of two EV rate plans for residential customers, who have an EV and/or battery storage and can charge during off-peak hours, in addition to shifting other household energy usage to off-peak hours.	Non-tiered, time-of-use plan.	• Peak (4 to 9 pm): $0.49/kWh • Partial-Peak (3 to 4 pm and 9 pm to 12 am): $0.38/kWh • Off Peak (12 am to 3 pm): $0.17/kWh			
PG&E EV-B	Electric vehicles	One of two EV rate plans for residential customers who want to track EV charging separate from home energy consumption with a dedicated meter.	Non-tiered, time-of-use plan.	• Peak (2 to 9 pm): $0.53/kWh • Partial-Peak (7 am to 2 pm and 9 to 11 pm): $0.29/kWh • Off Peak (11 pm to 7 am): $0.14/kWh			

California

Tariff, Rider, or Program Name	Tech Neutral or Specific?	Program Overview	Design Summary	Summary of Charges, Credits, Rate Details	EM&V	Stakeholder Context	Participation
SCE Smart Energy Program	Thermostats	During an Energy Event, smart thermostat providers are notified to temporarily adjust customers' thermostats to reduce demand on the grid.	Thermostats may be adjusted up to 4 degrees, max 4 hours per day. Participating customers must receive service under D, D-CARE, D-FERA, TOU-D or TOU-D-T. Critical peak pricing for business customers	• One-time rebate of $75 • Bill credits of up to $40/year			
SDG&E AC Saver Thermostat Program	Thermostats	Customers' thermostat settings will be remotely adjusted by SDG&E or a third part when conservation is needed.	Adjustment period between 12 and 9 pm, for no more than 4 hours (with opt-out). Customers on the Time-of-Use Plus rate plan participate in "Reduce Your Use" days between 2 and 6 pm (with opt-out).	$50 for registering thermostat, another $20 at the end of the year if the thermostat stays connected to Wi-Fi.			

California

Tariff, Rider, or Program Name	Tech Neutral or Specific?	Program Overview	Design Summary	Summary of Charges, Credits, Rate Details	EM&V	Stakeholder Context	Participation
Joint Appendix 13 (JA13)	Heat pump water heaters	A new protocol under the state's building energy code that will enable the code to reward smart electric heat pump water heaters for their grid benefits.	Intended for TOU rates. Upon receiving a demand management price or dispatch signal, the system will be capable of automatic event responses: Basic Load Up, Advanced Load Up, Return to Standard Operation, Light Shed, Deep Shed, Full Shed.	To be determined.	N/A	The California Energy Commission approved the new appendix to Title 24 in July 2020, as put forward by NRDC.	None so far.
Self-Generation Incentive Program	Heat pump water heaters	New SGIP incentive for heat pump water heaters as an important step toward additional energy storage for managing peak load.	Intended for TOU rates.	To be determined.	N/A	In early 2020, the CPUC approved an allocation of $45M for heat pump water heaters, out of $830M invested in SGIP over the next 5 years.	None so far.

California

Tariff, Rider, or Program Name	Tech Neutral or Specific?	Program Overview	Design Summary	Summary of Charges, Credits, Rate Details	EM&V	Stakeholder Context	Participation
Proxy Demand Resource (PDR)	Neutral	A CAISO market product where retail customer loads bid into the wholesale energy market for purposes of demand response.	3rd parties bid DR into CAISO market. Individual resources as small as 0.01 MW may aggregate to meet minimum load curtailment requirements of 0.1 MW (energy) and 0.5 MW (spin / non-spin).	Energy, spin, non-spin market payments, Resource Adequacy	Annual DR report		1,166 active proxy demand resources Registered.
Distributed Energy Resource Provider	Neutral	A CAISO market product that allows for DER aggregations to meet minimum capacity requirements and act as a single virtual resource.	Individual DER can aggregate to meet 0.5 MW minimum. Individual DERs within an aggregation must have a rated capacity <1 MW.	Energy, spin, non-spin market payments; not eligible for Resource Adequacy			7 DERP agreement holders
Non-Generating Resource	Energy storage	A CAISO market product created to account for the positive-negative range of a storage resource.	All NGR subtypes may aggregate to meet the 0.5 MW minimum capacity. 60-minute continuous energy requirement for non-Regulation energy management (REM) or 15-minute requirement for REM.	Energy, spin, non-spin, and REM; not eligible for Resource Adequacy			

Colorado

Tariff, Rider, or Program Name	Tech Neutral or Specific?	Program Overview	Design Summary	Summary of Charges, Credits, Rate Details	EM&V	Stakeholder Context	Participation
Xcel Energy AC Rewards	Neutral (Nest not supported)	Smart Thermostat aggregation program, primarily for peak load reduction	Xcel controls thermostat during events to lower cooling load; involves set point adjustment, pre-cooling, and cycling.	CO - $75 initial bill credit; $25 annual bill credit MN - $75 initial bill credit; $25 annual bill credit WI - $25 annual bill credit	Colorado Minnesota	Initial pilots in CO and MN converted to full programs with no limits in 2019	
Xcel Energy Storage Pilot Program	Battery Storage	Pilot program to test BTM storage and feeder-level storage systems with renewable generation.	6 houses with solar PV were given battery systems to test how batteries could be used to provide ancillary service support on a feeder and reduce feeder peak demand.	N/A	Yes; filed July 2020	Partnership with Panasonic	6 houses

Colorado

Tariff, Rider, or Program Name	Tech Neutral or Specific?	Program Overview	Design Summary	Summary of Charges, Credits, Rate Details	EM&V	Stakeholder Context	Participation
Black Hills Energy	Smart Thermostat	Rebate Program		$75 rebate			
Colorado Springs Utilities	Smart Thermostat	Rebate Program		$50 rebate			

Georgia – Georgia Power Co

	Tariff
Technology neutral	**Two-part Real Time Pricing (RTP) rates** • Hourly market prices • Day-Ahead (>250 kW) and Hour Ahead (>5MW) notification of hourly energy prices • Two-part rate structure to recover embedded costs for consumer baseline load • Scarcity price component added on top of RTP energy price on the top 100 high-load hours
Technology specific	**EV Rates** Plug-in Electric Vehicle (PEV) rate – Introduction of a super off-peak 11 pm – 7 am (1c/kWh) **"Smart usage" Residential Rate** • TOU kWh (Peak/Off-Peak) + NCP KW charge • Offered free Nest® thermostat who enrolled • 8,000 customers

Hawaii – HECO

	Tariff	Rider or Program
Technology neutral	**Residential TOU** • A pilot program with 3000 customers so far • 3 peak periods (on 0.4 $/kWh off 0.3 mid 0.1)	**Commercial Fast DR** • Direct load control – full or semi-controlled by HECO • 40 events or 80 events/yr with compensation 5$/kW-mo or 10$/kWmo respectively **Large commercial Direct load control** • Similar compensation and structure to small commercial program (see below) but applies to any load • Large business has 2 levels – utility dispatch or dispatch under frequency. For frequency dispatch HECO installs frequency response detector to dispatch load automatically **"Smart" Export** • TOU export rate for customers with solar + storage – limited to 4pm – 9pm; no compensation for exports in other hours
Technology specific	**Residential EV TOU RI and RI–EV only** • Basic TOU rate for EV charging the RI is single meter, Ri-EV only is for separately metered **Proposed Commercial EV Rates – EV-J, EV-P** • HECO has filed new commercial EV tariffs in 12/2020 (Docket no 2020-0152) • These are all 3 period TOU rates with a small demand charge • Separate metering required	**Residential & Small commercial Direct Load Control Water Heater & Air conditioner DR programs (EnergyScout)** • Customers have load control device installed and are paid 3$ / month for Water Heater and 5$/mo for AC • WH has 34,000 and AC 4,000 customers enrolled respectively – both fully subscribed • Commercial program is the same – Small Business Direct Load Control Program **Smart Charge Hawaii EV Program** • EV smart charging program run by ENEL in partnership with HECO • Customers incentivized with free or discounted JuiceBox wi-fi enabled smart chargers • JuiceNet platform controls charging and aims to maximize charging during the middle of the day

Massachusetts

Tariff, Rider, or Program Name	Tech Neutral or Specific?	Program Overview	Design Summary	Summary of Charges, Credits, Rate Details	EM&V	Stakeholder Context	Participation
National Grid BYO Device	Thermostat and Home Storage	Customers enroll devices with Energy Hub	Energy Hub receives telemetry data (15min) from the battery systems. Dispatch is sent through Energy Hub from NEISO. Energy Hub verifies performance and sends data to NG for billing. See Fact Sheet for more operational details	$25 upfront; $20 annual credits Battery - $225 per kW performed summer; $50 per kW winter	2019/20 Storage 2019 Thermostat		148 batteries >20,000 thermostats (NY, MA, RI)

Nevada – NV Energy

	Tariff
Technology neutral	**Residential Optional CPP** • CPP price ($.54/kWh) triggered on critical events • Only 12-14 days per year (1 pm - 7 pm, summer only) • Day-ahead notification • TOU kWh charges during non-critical events
Technology specific	**Residential Storage CPP + Demand Charge** • CPP price ($.55/kWh) triggered on critical events • Only 12-14 days per year (1 pm - 6 pm, Summer only) • Day-ahead notification • TOU kWh charges during non-critical events • Daily demand charge on-peak hours **EV Rates with Demand Charge** • Commercial fast charging rate includes daily Max Demand charges by TOU • EV residential includes a daily max demand charge • Only 1 customer on the rate

New York

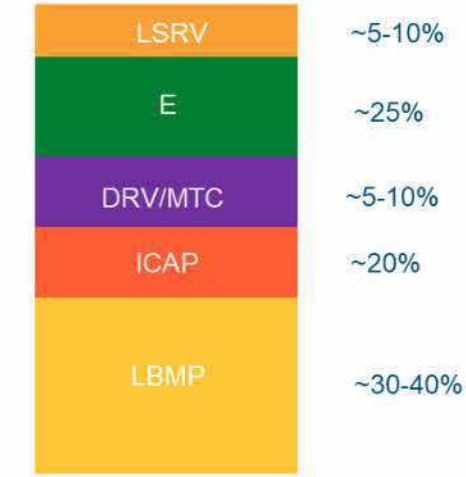
Tariff, Rider, or Program Name	Tech Neutral or Specific?	Program Overview	Design Summary	Summary of Charges, Credits, Rate Details	EM&V	Stakeholder Context	Participation
National Grid BYO Device	Thermostats	Customers can enroll devices with Energy Hub; dispatch is controlled by the ISO		$30 upfront; $20 annual credits			>20,000 cust. (NY, MA, RI)
ConEd SmartAC BYO Device	Thermostats	Customers enroll devices		Customer receives "cool points" to spend in the ConEd store	Yes; 2019	2018 - NY PSC folded this into the broader DSM portfolio of ConEd	>21,000 devices

New York

Tariff, Rider, or Program Name	Tech Neutral or Specific?	Program Overview	Design Summary	Summary of Charges, Credits, Rate Details	EM&V	Stakeholder Context	Participation
National Grid Distributed System Platform	Microgrid	Partnership with Buffalo Niagara Medical Campus and Opus One	Uses renewable generation, battery storage, and direct load control in a microgrid setting.	LMP+D pricing	See REV updates	Arose out of the NYREV docket	N/A
NYSEG BTM Storage Pilot	Battery Storage	Utility enrolls up to 8 home storage systems for aggregate control.	Targeted capacity of 1MW and 4.2MWh	Customer pays nominal fee for utility to install batteries	See REV updates	Arose out of the NYREV docket	8 customers

New York – VDER Value Stack

- First step towards value-based compensation for DERs – a transition away from NEM
  - Compensation is based on **net electricity injections** to the grid on an hourly basis
- Value Stack components include:
  - Locational System Relief Value (LSRV) – additional (higher) distribution value for DER projects located in capacity constraint locations and injecting power to grid during utility calls, notified day-ahead; value locked in for first ten years of the project's operation
  - Environmental benefits (E) – locked in for 25 years
  - Market Transition Credit (MTC) / Community Credit – by utility / locked in for 25 years, or
  - Distribution Relief Value (DRV) – locked-in utility avoided distribution value for 10 years based on power injected during top 245 hours each year
  - Capacity (ICAP) – market-based / variable (dispatchable DG only gets compensation for generation injections during peak system hour)
  - Energy (LBMP) – hourly market-based
- Available to most commercial/industrial projects – currently optional for residential



South Carolina

Tariff, Rider, or Program Name	Tech Neutral or Specific?	Program Overview	Design Summary	Summary of Charges, Credits, Rate Details	EM&V	Stakeholder Context	Participation
Duke Energy Power Manager	Smart Thermostats	Smart Thermostat aggregation program, primarily for peak load reduction	Duke can control thermostat settings during control events.	$75 gift card; $25 annual gift card	Preliminary analysis with forecasted CBA for winter modification	Starting in 2020, Duke added a winter component to the program.	252,000 devices (NC and SC combined)
Dominion	Smart Thermostats	Rebate Program		$100 rebate			

Utah – Rocky Mountain Power

	Tariff	Rider or Program
Technology neutral		**Residential Optional Time of Day Rider - Experimental** • Rider on residential schedule 1 or 3 applies 0.04 $/kWh on-peak and a -0.016 $/kWh (credit) for off-peak • On peak is 1 – 8pm

Technology specific	**Residential EV TOU Pilot**
	• Pilot study for 1000 customers
	• Separate meter required
	• Only on & off-peak periods, two rate options:
	  • 0.22 $/kWh On-peak and 0.07 $/kWh Off-peak or
	  • 0.33 $/kWh On-peak and 0.03 $/kWh Off-peak
	• Not allowed to join net metering program
		Cool keeper Program – residential and small commercial AC program
		• Direct load control Central AC program – utility sends smart controller to each customer
		• $20 sign up incentive, $30 annual incentive, 100 hrs max per year 2pm – 9pm weekdays during summer
		• More than 100k customers currently

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Vermont

Tariff, Rider, or Program Name	Tech Neutral or Specific?	Program Overview	Design Summary	Summary of Charges, Credits, Rate Details	EM&V	Stakeholder Context	Participation
Green Mountain Power - eSmartwater	Thermostats & Water Heaters	GMP provides water heater control and Nest	GMP provides all equipment to customer and controls for peak demand needs. Customers pay monthly fee based on services	$0.99 per month charge (water heater + Nest)			540 customers
Green Mountain Power Heat Pumps	Heat Pumps	Rebate Program		$400-600			

Washington

Tariff, Rider, or Program Name	Tech Neutral or Specific?	Program Overview	Design Summary	Summary of Charges, Credits, Rate Details	EM&V	Stakeholder Context	Participation
Avista EVSE Pilot Program	Electric vehicles	A pilot program launched in 2016 where Avista owned, installed, and maintained chargers for residential and workplace charging applications to provide demand response.	Avista used meter data to determine when to curtail charging load via signals sent to networked chargers. Customers were notified a day in advance via a phone app and could opt out.	Developed with Tariff Schedule 77. No incentives for participating in individual DR events.	Decreased average load per EV by 69.2% during curtailment periods.	Washington Utility and Transportation Commission approved the tariff for this pilot program.	84% average opt-in rate; 439 charging ports.
Avista EV TOU Rate	Electric vehicles	Avista plans to implement a commercial EV time-of-use rate starting in 2021, with a load management program. Residential TOU rates will be piloted starting in 2023.	The proposed rate provides for reasonable recovery of utility costs based on additional TOU energy charges, while eliminating demand charges.	To be determined.	N/A	Proposed in Avista's 2020 Transportation Electrification Plan.	None so far.
Avista Micro-Transactive Grid	Neutral	A microgrid pilot project to provide visibility and control of smaller loads and enable trading of energy, with the goal of increasing market participation for DER.				Installed in Spokane's University District, grant from WA Department of Commerce Clean Energy Fund.	Two buildings

Washington

Tariff, Rider, or Program Name	Tech Neutral or Specific?	Program Overview	Design Summary	Summary of Charges, Credits, Rate Details	EM&V	Stakeholder Context	Participation
PSE Rush Hour Rewards Program	Thermostats	PSE tested DR with Nest thermostats to evaluate their ability to pre-heat homes and minimize gas use during peak hours and is now conducting residential pilots in capacity constrained areas.	The program for residential customers relies on Nest's servers to remotely change the temperature set-point in homes in response to a program event.				
PSE Electricity Targeted Demand Side Management Pilot	Neutral	Rate schedule that applies to residential, commercial, and industrial customers in specific T&D deferral areas to support Non-Wires Alternatives.	Electric Tariff G / Schedule 219; incentives available for a list of cost-effective EE and DR measures.	Incentives based on cost-effectiveness using localized avoided cost.			
PSE EV Rate	Electric vehicles	From 2019-2023, PSE will install an EV charger at residential customer properties that agree to test shifting time of charging.	Electric Tariff G/ Schedule 552; electric service including charging service and dedicated chargers, off-peak credits.	PSE will cover 75% of the EV charger installation cost, up to $2,000. PSE may provide an incentive for EV charging during off-peak times.			

Washington

Tariff, Rider, or Program Name	Tech Neutral or Specific?	Program Overview	Design Summary	Summary of Charges, Credits, Rate Details	EM&V	Stakeholder Context	Participation
PSE Up & Go Electric	Electric vehicles	Pilot EV charging program using software that provides a grid-connected charging solution and helps the utility manage peak electricity demands.	Provides 500 qualified electric customers with a PSE-branded JuiceBox smart charging station.	Covered 75% of installation costs, up to 2,000 US dollars.		Partnership with Enel X.	500 customers
Seattle City Light	Electric vehicles	Pilot EV charging program in which Seattle City Light will use the data collected to analyze EV charging patterns and identify cost-effective ways to dually support grid optimization and electrification.	Provides customers with a JuiceBox smart charging station and support for home installation.	Monthly fee.		Partnership with Enel X.	70 customers

Tariff Survey

Deep Dive on Energy Storage Programs

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Energy Storage Program Overview

- Program compensation across several jurisdictions varies significantly (50 $/ kW-year to 400 $/ kW-year)
  - Compensation often has multiple tiers, most commonly there is compensation for enrollment and an annual payment
    - Two programs included some form of performance-based compensation (an upfront incentive and a performance-based payment)
  - In most programs the utility compensates the customer directly rather than the aggregator (PSEG Long-Island and National Grid being the exceptions)
- PSEG Long Island and PGE compensated customers for distribution value
- All programs involved a DERMS provider and most had multiple aggregators
- Most programs required separate metering for energy storage
- In most programs the customer owned the device
  - HECO and GMP offered lease options through the aggregator
- Programs were 2.5 – 5 years in length

PSEG Long Island

- NY has goals of 1,500 MW of storage by 2025 and 50% renewable electricity by 2030
- In Jan. 2020, VDER Phase 2 began allowing residential storage systems to opt into VDER and capture DER value
- VDER customers can access existing CSRP and DLRP tariffs (DR programs) which form the compensation for the program
- Targets Locational System Relief Value (LSRV) areas
- PSEG Long Island calls events several times per summer when the system is near its peak demand (events can be up to 4 hours)
- Found a cost-benefit ratio of the program of 1.29, with the largest benefit stream being the Avoided Distribution Capacity
- PSEG Long Island notifies aggregators of events and aggregators are responsible for managing customers' batteries

PSEG Long Island Residential Storage Program	
Size of program (MW)	7.6 MW storage capacity 3,468 kW of load reduction
# of customers enrolled	90 customers in 2019 720 customers by 2022
Duration of program	4-year program, proposal to lock incentives in for 10 years is pending
Cost of program	$3.4M
DDSR owner	Customer
Aggregator required?	Yes
Participant compensation	- Aggregators receive $96/kW-yr payment for both CSRP and DLRP - 0.25 $/kWh performance-based payment during events - Aggregator can decide how to compensate customers
Valuation	Avoided distribution, generation, and transmission costs
Metering	Separate meters
DERMS	EnergyHub's Mercury platform

National Grid (MA)
Connected Solutions

- In February 2019, ISO-NE was the first to award Sunrun a bid to provide capacity
  - The first Bring Your Own Battery DR program in the US
- National Grid ran a demonstration project in summer 2019 with 63 batteries
  - Found that 63% of devices enrolled on a given day successfully performed in an event
  - Each battery saved an average of 5.5 kW during events
- Compensation is intended to be market transformational
  - Performance based compensation awarded for average kW curtailed and incentive is locked in for a 5-year period
- EnergyHub enrolls customers, receives telemetry data from National Grid, and verifies performance
- Connected Solutions programs exist in other National Grid jurisdictions and for other DERs
- Study into which DERs have the largest market potential informed the technologies chosen but involve different incentives and performance requirements

National Grid Connected Solutions	
Size of program (MW)	Anticipated to be 30-34 MW
# of customers enrolled	148 end of 2019
Duration of program	Locked in incentive for 5 years
Cost of program	N/A
DDSR owner	Customer
Aggregator required?	Yes
Participant compensation	- Compensated for average kW load reduction ($225/kW summer, $50/kW winter) - Payments go to aggregator or directly to customer
Valuation	Market transformation incentive, avoided energy, capacity, GHG emissions
Metering	Separate meters
DERMS	EnergyHub's Mercury platform

Massachusetts: https://www.nationalgridus.com/MA-Home/ConnectedSolutions/BatteryProgram
Rhode Island: https://www.nationalgridus.com/RI-Home/ConnectedSolutions/

HECO (HI)
Grid Services Purchase Agreement

- Sunrun and Open Access Technology International (OATI) signed a Grid Services Purchase Agreement (GSPA)
  - OATI is the DERMS, Sunrun the aggregator
  - Compensation flows from HECO to OATI to Sunrun
- Sunrun paid by HECO for enrolling customers as well as grid services
  - No public data on final value of the program, but publicly HECO has set targets of $2,000 in grid services per customer over their lifetime of participation
- The GSPA is part of HECO's Renewable RFP to replace 2 fossil fuel plants
- Allows BTM storage to participate in HECO's emerging grid services market
- Batteries provide AS services in addition to capacity (Fast Frequency Response)

HECO - Grid Services Purchase Agreement	
Size of program (MW)	4.3 MW
# of customers	1,000 customers by 2024
Duration of program	4 years
Cost of program	N/A
Battery owner	Typically customer, but option to lease from Sunrun
Aggregator?	Yes
Participant compensation	Participating customers receive $100 - $150 upfront + credits on their electricity bills
Valuation	Capacity and AS (fast frequency response)
Metering	N/A
DERMS	OATI's webSmartEnergy system

https://www.hawaiianelectric.com/hawaiian-electric-and-open-access-technology-international-plan-for-innovative-grid-services-wins-puc-approval

Green Mountain Power (VT)

- GMP offers two tariff options:
  - Energy Storage System (ESS): GMP leases batteries to customers
  - Bring Your Own Device (BYOD): customers purchase storage from aggregators
- Completed a pilot with Tesla
- Program is now open to six aggregators with a process in place to approve additional aggregators in future
- Emphasis on competitive markets after GMP helps boost early adoption
- Loan loss reserve fund to reduce financial risk for non-participating customers (ESS only)
- Incentive payments for BYOD are booked as a direct power supply expense

Green Mountain Power	
Size of program (MW)	5 MW per tariff (10 MW total)
# of customers	500 customers (ESS) 500 customers (BYOD)
Duration of program	2.5 years
Cost of program	$27M
Battery owner	GMP (ESS) Customers (BYOD)
Aggregator?	Yes, in BYOD program
Participant compensation	- In ESS, customers get reduced lease prices for battery system - In BYOD, customers receive an upfront incentive of $850-950/kW plus $100/kW if the system is in a constrained area
Valuation	Capacity, energy, and AS (operating reserves, frequency regulation)
Metering	Separate meter
DERMS	Provided by aggregator

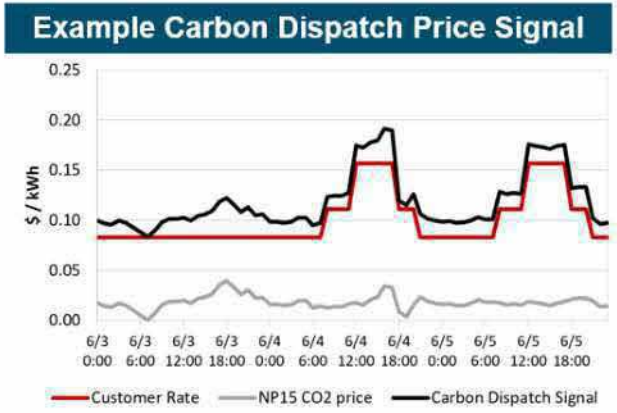
Portland General Electric (OR)

- PGE began using BTM storage from four vendors to serve as a VPP in fall 2020
- Enrollment is focused on specific neighborhoods and programs
  - PGE is targeting three neighborhoods in (PGE Smart Grid Test Beds) to evaluate the impact of concentrated BTM storage adoption on one substation
  - Customers can receive up to a $3,000 rebate plus a monthly credit
  - Solar Within Reach customers (low- and moderate-income) receive a $5,000 rebate plus a monthly credit
- Customers with existing batteries can join and receive monthly credits
- PGE controls battery 24/7 (instead of just during DR events)
- PGE will charge batteries for customer usage if blackout conditions are forecasted
- Customer compensation drops from $40 to $20 per month if the customer charges from solar

PGE	
Size of program (MW)	4 MW
# of customers	525 customers
Duration of program	5-year pilot
Cost of program	N/A
Battery owner	Customer
Aggregator?	Only third-party sellers
Participant compensation	- Monthly credits and/or upfront rebates depending on the program
Valuation	Energy, system-wide and local capacity and T&D
Metering	Separate meter
DERMS	Virtual Peaker's semi-custom software

SGIP – GHG Performance Incentive

- Impact evaluation studies found SGIP was consistently falling short of its goal to reduce GHG emissions in California
- The CPUC mandated (D. 19-08-001) that new commercial projects must reduce annual GHG emissions by at least 5 kg per kWh of rebated capacity
  - Underperformance results in reduction in annual incentive payment (capped at 100% of annual incentive)
  - The 5kg threshold was determined using a publicly available storage dispatch optimization tool demonstrating this threshold could be achieved by most projects whilst also maximizing their bill savings
  - The penalty is $1,000 per metric ton for all emissions above the target of 5kg / kWh – if the storage project increased annual GHG by 25 kg/kWh or more, their performance incentive would be zero.
    - The worst performing storage project in the 2017 impact evaluation increased emissions by just under 25kg / kWh
- WattTime provides an hourly marginal GHG signal API for each project to ensure low emission dispatch*
- Storage projects co-optimize for bill savings and GHG



Tariff Survey

Deep Dive on Location-Based DER

Guidehouse

aps

Location-Based DER Overview

- Utilities that have identified capacity constraints in specific areas of the grid are working towards DER programs and tariffs as non-wires alternatives, but most remain in pilot phases.
  - Investment in DER is determined by the value of deferral, which varies as a localized avoided cost.
  - Aggregators are included in some cases, but in others the program is managed by the utility.
- Utilities in California in particular have invested a significant amount of time and planning into location-based DER as directed by the California Public Utilities Commission through the Distribution Resources Plan (DRP) in R.14-08-013 and the Integrated Distributed Energy Resources (IDER) proceeding in R.14-10-003.
  - The DRP required the California IOUs to issue RFOs for demonstration projects.
  - The IDER recently issued a new pilot tariff for customers with behind-the-meter DER who sign up with an approved aggregator.
- Since 2013, SCE has also conducted the Preferred Resources Pilot (PRP) with a (to be completed) 200 MW portfolio of EE, DR, energy storage, and renewable DG sourced both through existing customer programs and new solicitations. Elements of SCE's DRP demonstrations are part of the larger PRP.
- Also in California, SMUD has taken a technology-specific approach with the new Energy StorageShares model, which is starting up its first program.
- PSE in Washington is launching an EE/DR focused program for two targeted geographic areas instead of the All-Source RFP approach used in the past.

Partnership Pilot (CPUC R.14-10-003) (CA)

Program Overview	Design Summary	Summary of Charges, Credits, Rate Details	EM&V	Stakeholder Context	Participation
5-year pilot under a CPUC Proposed Decision, beginning in 2021. A new tariff with a tiered payment structure open to any DER customer type. Behind-the-meter DER operate in response to dispatch signals communicated from a utility via a pre-approved DER service aggregator, for the purpose of addressing grid needs and deferring distribution investment. Deferrals would follow the Distribution Investment Deferral Framework (DIDF) (PG&E, SCE) established in the DRP proceeding. The Utilities would use the "Ratable Procurement" model: Procuring incremental capacity annually to defer long term needs.	Customers partner with aggregators by enrolling in the tariff and allowing their DER to be dispatched by aggregators, for the purpose of addressing grid needs identified in the DIDF process. Marketing to customers and enrollment of customers would be performed by aggregators with Utilities serving as marketing partners. Enrollment would extend from the subscription period launch until (1) enough offers accepted to meet grid need plus a 20% Procurement Margin or (2) date determined by Utilities for contingency plan implementation. Aggregators would file offer reservations for either a portion or all of the needed capacity at the price set by the utility Tariff Budget. The Tariff Budget will be 85% of the cost cap of a planned investment. The aggregator would be required to show an affidavit of interest from host customers to demonstrate available capacity by the end of a pre-determined reservation period.	Four-tier payment structure: 1. Deployment – Install DER 2. Test – Confirm dispatch capability 3. Reservation – Reserve capacity and energy 4. Performance – DER are dispatched Details to be determined.	N/A	A recent CPUC proposed decision adopting pilots to test two frameworks for procuring DER that avoid or defer utility capital investments. The IDER and DRP working groups recorded activities here.	None so far.

Preferred Resources Pilot (SCE)

Program Overview	Design Summary	Summary of Charges, Credits, Rate Details	EM&V	Stakeholder Context	Participation
In 2013, SCE launched the Preferred Resources Pilot (PRP) to understand how a diverse portfolio of preferred resources can meet local capacity needs and load growth. The PRP "is a multiyear study designed to determine whether clean energy resources – including solar, wind, energy storage, energy efficiency and energy conservation – can be acquired and deployed to offset the increasing customer demand for electricity in central Orange County." (An area covering two transmission-level substations) Market potential studies and technology effectiveness factors were the starting point to determine a possible resource mix.	Sourcing focused on 1) using existing programs and broad, CPUC-approved competitive solicitations and 2) implementing region-specific-competitive solicitations: • EE acquired through business and residential customer programs for buildings and appliances • DR acquired through competitive solicitations, mainly enabled by customer-sited energy storage • Energy storage acquired through competitive solicitations and from customer programs such as the Self-Generation Incentive Program • Renewable DG behind-the-meter through programs and tariffs, including Single-Family Affordable Solar Homes, New Solar Homes Partnership, and NEM 2016 Design Report	Various charges and credits by resource and program. Examples: • Automated DR: Business customers may earn up to $300 per kW • Summer Discount Plan: Rewards for A/C to be remotely shut off during energy events that affect their area • Save Power Day: Up to $100 annually in bill credits for reducing usage during peak periods on designated days	The 2018 PRP Annual Report. "The development of standardized distribution service products and associated pro forma contracts coupled with pre-approved contracting options could speed and add clarity to the process." → To be addressed in IDER SCE initially estimated an 85% effectiveness factor at full deployment, but the portfolio's first-year operation performed at a 68% effectiveness factor.	SCE initiated its PRP to validate the State's assumptions that a portfolio of DER could perform like a large gas-fired power plant, while ensuring reliable and affordable energy delivery; approved by the CPUC.	SCE has released two RFO's specific to the PRP to date. A 200 MW portfolio will be available by 2021. As of May 2019, nearly 127 MW of new DER were online; an additional 73 MW had been sourced.

Distribution Resources Plan (R.14-08-013)

Examples

PG&E

2017 DRP RFO

- The proposed location for this pilot demonstration is PG&E's Huron substation, which is located within PG&E's Gates distribution planning area.
- Seeking:
  - 4 MW of distribution hosting capacity
  - 2 MW of distribution load capacity
- Only DER that are categorized as wholly incremental or partially incremental will be considered eligible for the purposes of this Solicitation.

SCE

Multiple demonstrations including Demonstration C: Demonstrate DER Locational Benefits, which is in the PRP area.

https://www.edison.com/content/dam/eix/documents/innovation/drp-demo-fact-sheet.pdf

SDG&E

2017 DRP RFO

SDG&E is seeking the following product types:

- EE – third party programs only
- DR – third party programs only
- Renewables – third party owned / contracted resources OR utility owned resources
- Energy Storage – third party owned / contracted resources OR utility owned resources
- DG – third party owned / contracted resources OR utility owned resources

"SDG&E will consider single resources or integrated hybrid resource types (combinations of the resource types listed above) to meet the total required distribution capacity for each circuit. SDG&E will sign a maximum of one contract per circuit."

Energy StorageShares (SMUD)

Program Overview	Design Summary	Summary of Charges, Credits, Rate Details	EM&V	Stakeholder Context	Participation
Commercial customers install storage in a location with a distribution feeder system that is maxed out and is in line to be upgraded, and other customers buy a "share" of the battery system. The StorageShares program is being implemented based on an initial 4-MW battery, but additional sites are being evaluated. The battery will be installed in an area forecasted to have increased load growth due to planned new residential subdivisions that will have rooftop solar, and potential load increase due to planned indoor agricultural facilities.	Eligible commercial customers are given the option to make an up-front investment into the StorageShares program instead of installing a battery behind-the-meter at their business. • Customers must actively be considering the adoption of energy storage for demand charge reduction. • Customer share acquisition is limited to no more than 50% of the customer's peak demand within the most recent 12 months. • Customers participating in Energy StorageShares cannot install on-site energy storage to obtain further demand charge reduction.	In exchange for the investment into the program, participants receive shares which provide 1 kW of demand charge reduction savings per share that is provided as a monthly credit on the customer's bill for a 10-year term. Share prices in 2020 ranged from $475 to $520 per share depending on a customer's rate class.	2020 Compliance Report	Assembly Bill 2514 / Assembly Bill 2227 The program is part of SMUD's overall goal of having 9 MW of energy storage by the end of this year and 75 MW by the end of 2026.	Electrify America is the first Energy StorageShares program (4 MWh storage project with 4,000 shares).

Targeted Demand Side Management Pilot (PSE)

Program Overview	Design Summary	Summary of Charges, Credits, Rate Details	EM&V	Stakeholder Context	Participation
The Targeted Demand Side Management Pilot (TDSM) is an Energy Efficiency pilot program from Puget Sound Energy (PSE) focusing on delivering demand response and energy efficiency to geographically specific areas as part of non-wires (or pipes) alternative solutions to T&D infrastructure needs. Schedule 219 applies to residential, commercial, and industrial customers in specific T&D deferral areas to support these non-wires alternatives. Aggregators bid on RFPs to provide the targeted EE and DR services.	Customer Electric Tariff G / Schedule 219; incentives available for a list of cost-effective EE and DR measures. Aggregators for targeted DR must meet requirements: • Be available during weekday peak hours, typically between 7 a.m. to 10 a.m. in the morning, and 5 p.m. to 9 p.m. in the evening, from November 1 through February 28/29 • Provide load response with one of the following notification options: (1) hour ahead notification of calling DR events, (2) day ahead notification, or (3) a combination of hour ahead and day ahead notification • The total event time from November 1 through February 28/29 shall be no more than 40 hours per individual product	Customer incentives based on cost-effectiveness using localized avoided cost. PSE will pay bidders based on MW of delivered load reduction that meet the performance parameters. • Monthly capacity payments • Monthly energy usage payments • Other payments as structured in bidder's response and agreed by PSE	N/A	In September 2020 PSE withdrew draft DR and All-Source RFPs filed with the Commission, intending to integrate targeted demand response into a separate Targeted Demand Side Management RFP.	2020-21 RFP issued December 29, 2020 "soliciting support for existing demand side management products, programs and/or services, delivered to targeted geographic areas" • Bainbridge Island: Reduce winter peak capacity by 3.3 MW by 2029 to postpone a new substation • Duvall: Reduce winter peak natural gas usage by 3,000 MBH by 2029 to defer a new natural gas pipeline PSE is also scoping four additional pilots in the 2020-2021 Biennial Conservation Plan.